Posudek diplomové práce

Matematicko-fyzikální fakulta Univerzity Karlovy

Autor práce	Bc. Michal Ivičič
Název práce	Vyhlazování trojúhelníkových sítí se zachováním význačných rysů
Rok odevzdání	2022/2023
Studijní program	N0613A140018 **Studijní obor**

Autor posudku	Tobias Rittig, M.Sc.	**Role**	Opponent
Pracoviště	KSVI		

Text posudku:

The thesis describes a mesh smoothing approach for subdivision surfaces where the original vertices are fixed and new vertices are moved to form a smooth surface. The thesis has both a theoretical foundation in geometry processing and an applied implementation part. The student implemented a standalone application with a real-time mesh viewer that runs a variety of algorithms on loaded meshes and displays the results. The text mostly focuses on the theoretical description and the algorithmic challenges.

Overall the thesis text has an excellent academic structure, is written well and can be understood even by non-expert readers. The level of English is adequate and significantly more polished than typical theses on this level at this university.

The introduction gives a clear picture of the work, sets out the goals and has a refreshing formatting. The almost empty page 6 could have been avoided but that is a minor issue.

The background section contains all relevant theoretical knowledge that is required for the understanding of the whole thesis. The formalism is consistent throughout the work and forward/backward references aid the mental connection of concepts while reading.

A minor comment on the generation of discrete directions on the hemisphere on p.38: The proposed method leads to sample clumping around the zenith and there exist ways to avoid that. See the chapter "13.6 2D Sampling with Multidimensional Transformations" in pbr-book.org (Physically Based Rendering: third-edition, Pharr, Jakob, Humphreys)

The writing style gives high level overviews and lookouts before diving into deeper technical descriptions. The reader's understanding is supported with example pictures of the relevant concepts at hand.
The only criticism in this regard could be seen in section 3.5 where a lot of low-level details are described purely in text and could have used a few more drawings to illustrate the vertices, vectors etc.
In the results section 4.2, polynomial approximations to the measured run-times are given. It would have been nice to plot these polynomial directly, instead of leaving this work to the reader.
And finally, on page 53+54 some references to figure 4.9 are messed up with 4.8.

Implementation
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During an in-person session, the student presented the application and its various parameters to me. We have looked at a variety of input meshes, with both positive and negative examples and the results confirm the overall image painted in the thesis.
He also presented the code itself to me, walked me through the structure and design decisions. Any follow-up questions were promptly answered.
I am conviced that the student has extended knowledge on the topic and has worked on the implementation himself.

In conclusion, this is a high-quality master thesis where it is hard to point out any flaws. The text presents a solid piece of research, both theoretically and in the implementation. The results are not production-quality yet, but for an all-new implementation in limited time they are quite impressive.

Questions
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1. On page 31, the equation $P(t)$ should interpolate v_1 & v_2 but they are not in the formula. Please explain.
2. In table 4.1 (p51), the Laplace2 solver time for 10386 vertices is more than the total runtime.
3. In figure 4.5b (p59) the top right looks like it introduced a gap along the sharp seam. What happened there?
4. Do the surface oscillations in general come from an underdetermined linear equation system?
5. The bulging of the flat section in figure 4.7 is discussed in the limitations. Isn't it a matter of the order of operations. If the VGS would be treated first, and only then the fairing would take place, could these problems (related to the changing boundary) be avoided? Or would an iterative approach (as proposed for runtime improvements) help?

Práci k obhajobě.
Yes, I recommend this thesis for defense.

Práci na zvláštní ocenění.

Pokud práci navrhujete na zvláštní ocenění (cena děkana apod.), prosím uveďte zde stručné zdůvodnění (vzniklé publikace, významnost tématu, inovativnost práce apod.).

Datum   **Podpis**

30.08.2023